

24. TRIASSIC FORAMINIFERS FROM SITES 761 AND 764, WOMBAT PLATEAU, NORTHWEST AUSTRALIA¹

Louissette Zaninetti,² Rossana Martini,² and Thierry Dumont³

ABSTRACT

The Late Triassic foraminifers encountered in the cores from ODP Leg 122 Sites 761 and 764 are, on the basis of *Triasina oberhauseri* and *Triasina hantkeni*, late Norian and Rhaetian (*Triasina hantkeni* Biozone) in age. The reefal carbonate platform penetrated at both sites is characterized by inner shelf (intertidal to lagoon), patch reef, and outer shelf facies.

INTRODUCTION

Upper Triassic sediments were drilled offshore northwest Australia in 1988 during Ocean Drilling Program (ODP) Leg 122 (Haq, von Rad, et al., 1990). Four sites (759, 760, 761, and 764) were drilled on the Wombat Plateau, the northern promontory of the Exmouth Plateau (von Rad et al., 1989a; Fig. 1A). These sites provided the opportunity for reconstructing a composite section of Upper Triassic cores from the Carnian to the Rhaetian, because the Wombat Plateau experienced non-deposition and/or erosion during the whole Jurassic, followed by starved pelagic sedimentation from the Cretaceous to the Holocene. The Triassic sediments, emplaced in a prift situation produced by the oceanic opening between India and Australia, are unconformably overlain by the so-called postrift unconformity (Barber, 1988; von Rad et al., 1989b). The maximum angular unconformity and the deepest erosion occur at the southern Sites 759 and 760, at which only siliciclastic-dominated Carnian (middle to upper) to upper Norian sediments were recovered. This study is based upon the carbonate-rich neritic Rhaetian section with an abundant microfauna that was recovered at Sites 761 and 764.

UPPER TRIASSIC SERIES

Detailed sedimentologic studies of the drilled Triassic series can be found in Borella et al. (this volume), Dumont (this volume), and Sarti et al. (this volume). The oldest sediments consist of Carnian silty claystones from a prodelta environment. Their shallowing-upward tendency led during the latest Carnian and Norian times to the episodic development of neritic carbonate wedges, followed at Site 760 by late Norian restricted marginal marine siliciclastics (which confirm the general regressive trend). The depositional evolution was disturbed by a tectonic event that produced extensional deformation of the Carnian deposits and a major depositional gap during part of Norian (early and middle?), which is overlain by a local angular unconformity at Sites 759 and 760. According to the seismic stratigraphy, the bottom of the cored interval at Site 761 does not overlap the uppermost Triassic cores at Site 760, but sediments of the same type and age (late Norian pollen and dinoflagellates; Brenner, this volume, chapter 23) were recovered at both sites; thus, there is probably no

major break between the two. This is in turn overlain at Site 761 by a sharp sedimentary break followed by a new shallowing-upward sedimentary sequence of Rhaetian age, which is capped by the postrift unconformity and comprises schematically two units: (1) a lower, terrigenous-rich, transgressive unit showing both shallow open-marine and external platform environments and (2) an upper regressive carbonate unit with lagoonal to intertidal deposits. A third overlying unit recovered at Site 764 does not exist at Site 761 because of Jurassic erosion. The third unit is generally transgressive and also of Rhaetian age.

RHAETIAN SEQUENCE EVOLUTION AND ENVIRONMENTS

Seismic stratigraphy and microfacies analysis (Dumont, this volume) show that there is a large overlap between Sites 761 and 764, although the basal Rhaetian sequence boundary was recovered only at Site 761 and the youngest cores were recovered at Site 764. The detailed lateral correlation over a distance of about 20 km allowed by this overlap improves our knowledge of its sequence evolution. The vertical evolution shows the superposition of two shallowing-upward sequences; the lower one consists of two units interpreted as a transgressive systems tract and a highstand systems tract, respectively, whereas upper sequence, which is preserved only at Site 764 (unit 3), comprises both a transgressive systems tract and a condensed interval, in addition to a possible highstand. Except for the absence of the upper sequence at Site 761, which is an artifact due to later rift tectonics, the main syndepositional lateral changes are due to the greater development of patch reefs at Site 764 (Williamson et al., 1989). However, as shown by Dumont (this volume, fig. 2), these environmental changes do not obliterate the similarities of the sequence evolution at both sites, which can be accurately correlated based upon gamma-ray log and microfacies comparisons.

MICROFAUNAL ANALYSIS

The stratigraphic distribution of the Triassic (late Norian to Rhaetian) foraminifers has been compared at Sites 761 and 764. The correlation between the two cored sections (Dumont, this volume) is based on the microfacies, carbonate content, and fragments of megafossils. Based on the foraminifers, the sediments of the lower portion of the two sites can be regarded as upper Norian (*Triasina oberhauseri* Biozone) and those of the upper portion as Rhaetian (*Triasina hantkeni* Biozone), up to the contact with the postrift series (Cretaceous to Holocene).

The Triassic section can be subdivided using the foraminiferal analysis (Fig. 1B) into three intervals at both sites.

¹ von Rad, U., Haq, B. U., et al., 1992. *Proc. ODP, Sci. Results*, 122: College Station, TX (Ocean Drilling Program).

² University of Geneva, 13 rue des Marais, 1211 Genève 4, Switzerland.

³ University of Grenoble, rue Maurice Gignoux, 98031 Grenoble Cedex, France.

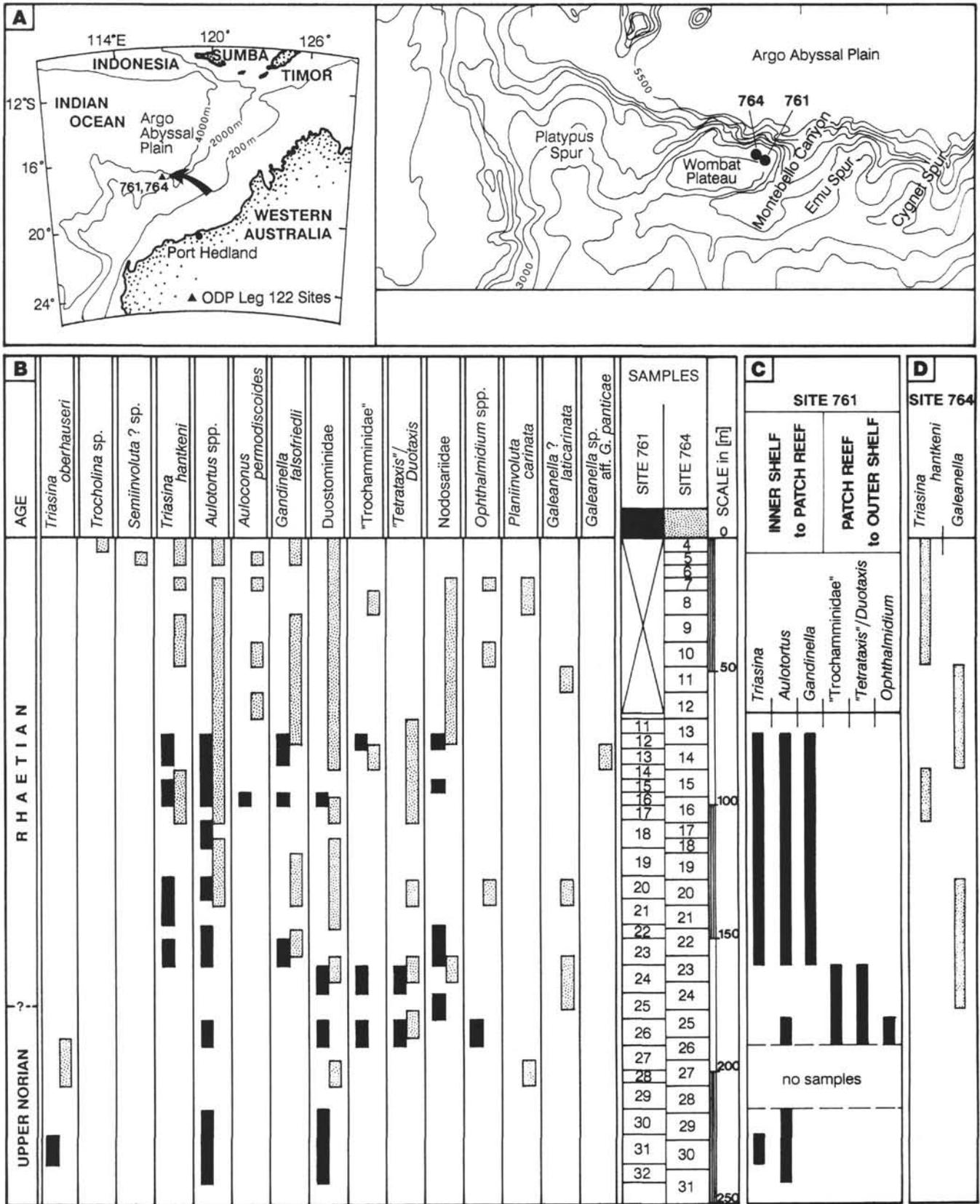


Figure 1. A. Location of Sites 761 and 764. B. Distribution of foraminifers at Sites 761 and 764. C. Alternation of Aulotortidae and *Gandinella* sp. with other foraminifers at Site 761. D. Alternation of *Triasina hantkeni* with *Galeanella* spp. at Site 764.

Site 761

The basal interval (Samples 122-761C-32R-CC, 1–5 cm, to 122-761C-30R-1, 7–9 cm) is characterized by a less rich microfauna than that of the upper intervals. The foraminifers are represented by Triasininae (rare *Triasina oberhauseri*; Pl. 1, Fig. 3) and Aulotortinae (*Aulotortus communis* (Kristan), *Aulotortus* ex gr. *sinuosus* (Oberhauser), *Aulotortus friedli* (Kristan-Tollmann), and *Aulotortus* spp.; Pl. 2, Figs. 4 and 10–12), normally associated with Duostominidae (Pl. 3, Fig. 1, and Fig. 1B). On the basis of *Triasina oberhauseri*, we consider this microfauna to be of late Norian age.

The second interval (Samples 122-761C-26R-CC, 16–19 cm, to 122-761C-24R-1, 69–73 cm) (we did not study any samples in the interval from Samples 122-761C-29R-CC, 4–6 cm, to 122-761C-27R-1, 41–44 cm) is characterized by a marked change in the microfaunal association: the Aulotortidae (Aulotortinae and Triasininae) are either rare or completely absent. The diagnostic foraminifers are “*Tetrataxis*,” *Duotaxis birmanica* Zaninetti and Brönnimann (see Brönnimann et al., 1975), and *Ophthalmidium* spp. (Pl. 3, Figs. 5–8 and 13). Associated with these forms are Lituolidae?, “Trochamminidae,” Textulariidae?, and Endothyridae (Pl. 3, Figs. 9–12, 15, and 16). The Duostominidae are common in this interval (Pl. 3, Fig. 3), showing a certain independence with respect to the type of microfacies. They are probably represented by different genera, which are not identifiable in thin section. The microfauna of this intermediate interval does not contain any diagnostic species; hence, it cannot be precisely dated, but its stratigraphic position between the cores with *Triasina oberhauseri* and with *Triasina hantkeni* places it in the upper Norian to lower Rhaetian.

The uppermost interval, which begins with Sample 122-761C-23R-3, 40–44 cm, and extends to the top of the hole, is interrupted by an erosional surface within Section 122-761C-11R (Fig. 1B). In this third interval, the microfauna is rich and more varied than in the previous intervals. *Triasina hantkeni* is common (Pl. 1, Fig. 1 and 2), and the main species of *Aulotortus* have been recorded (*Aulotortus communis*, *Aulotortus friedli*, *Aulotortus* ex gr. *sinuosus*, *Aulotortus impressus* (Kristan-Tollmann), and *Aulotortus* spp.; Pl. 1, Figs. 11 and 12, and Pl. 2, Figs. 1–3 and 5–9), as well as rare *Auloconus permodisoides* (Oberhauser) (Core 122-761C-16R), *Glomospirella* spp., *Gandinella* ? sp., and *Ammobaculites* sp., which are associated with Duostominidae, “Trochamminidae,” and Nodosariidae (Fig. 1B). Although it is commonly associated with Aulotortidae in the upper portion at Site 764, *Gandinella falsofriedli* (Salaj et al., 1983) occurs only sporadically at Site 761 (Pl. 1, Figs. 4–8).

Site 764

As at Site 761, we also found cores with abundant Aulotortidae alternating with cores in which only smaller foraminifers occur at Site 764. These alternations, however, are less obvious than at Site 761 (Fig. 1C). They are due to the varying carbonate content at both sites. Where the sediments are carbonate rich, the Aulotortidae are predominant. Site 764 is further characterized by the common occurrence of *Auloconus permodisoides* and by the appearance of *Galeanella? laticarinata* Al-Shaibani, Carter, and Zaninetti. These forms are commonly associated with “*Tetrataxis*,” *Duotaxis birmanica*, and *Ophthalmidium* spp.

The basal carbonate interval, between Core 122-764B-31R and Sample 122-764B-27R-1, 91–104 cm (Fig. 1B), can be compared in full with the basal interval at Site 761 (Core 122-764B-32R to Sample 122-764B-30R-1, 64–67 cm). It is characterized by *Triasina oberhauseri* (Pl. 4, Fig. 1) and

Aulotortus sp. in association with *Planiinvoluta carinata* Leischner and Duostominidae. The age of this interval is probably late Norian on the basis of the occurrence of *Triasina oberhauseri*.

The second interval extends from Samples 122-764B-26R-1, 58–60 cm, to 122-764B-21R-CC, 18–21 cm, and ends before the abundant occurrence of the Aulotortidae. In this interval, the smaller foraminifers predominate. They are represented by Nodosariidae, Ataxophragmiidae?, Duostominidae, “Trochamminidae,” Miliolidae?, “*Tetrataxis*” sp., *Duotaxis birmanica*, *Ophthalmidium* spp., and *Galeanella? laticarinata*, which first appears in Core 122-764B-24R (Pl. 4, Fig. 6, Pl. 5, Figs. 1–3 and 5, and Fig. 1B). In Core 122-764B-22R, we found *Gandinella falsofriedli*, which normally occurs together with Aulotortidae, as in the upper interval. The age of this intermediate interval is late Norian? to early Rhaetian.

The third interval extends from Sample 122-764B-20R-1, 106–109 cm, to the top of the cored section (Fig. 1B). This interval is dominated by the Aulotortidae: *Aulotortus sinuosus*, *Aulotortus communis*, *Aulotortus* spp., *Auloconus permodisoides*, and *Triasina hantkeni*, which was recorded previously in Core 122-764B-16R (Pl. 4, Figs. 2–5). The Aulotortidae commonly occur together with Nodosariidae, Duostominidae (Pl. 4, Figs. 8–10 and 15), and particularly *Gandinella falsofriedli* (Pl. 4, Figs. 11–14). In Core 122-764B-14R, we also found *Galeanella* sp. aff. *G. pantica* Zaninetti and Brönnimann associated with the Aulotortidae. Interruptions in the distribution of the microfaunas dominated by the Aulotortidae are characterized by the development of small foraminifers with microgranular or porcelaneous walls, such as “Trochamminidae,” Endothyridae, small miliolids, “*Tetrataxis*” *inflata* Kristan, *Duotaxis birmanica*, *Ophthalmidium* spp., *Planiinvoluta carinata*, *Planiinvoluta? irregularis* Salaj, Samuel, and Borza, and *Galeanella? laticarinata* (Pl. 4, Fig. 7, and Pl. 5, Figs. 6–10 and 17–21). At the top of Site 764, *Trocholina* sp. is present, as well as a doubtful form, tentatively placed in *Semiinvoluta* Kristan.

MICROPALAEONTOLOGICAL COMPARISON BETWEEN SITES 761 AND 764

The microfaunal analysis shows an overall similarity between the two sites, with the predominance of the Aulotortidae at the base and, particularly, at the top of the sections. Duostominidae and Nodosariidae occur at both sites. They are, however, more common at Site 764. Also, the group “*Tetrataxis*”–*Duotaxis* and above all the Miliolina, represented at Site 761 only by *Ophthalmidium* spp., are more common at Site 764. *Galeanella?* and *Planiinvoluta* were not observed in Site 761. This is perhaps an indication of a more external reefal sedimentation at Site 764. We further observed at Site 764 a regular alternation of cores with *Triasina hantkeni* and cores with *Galeanella? laticarinata* (Fig. 1D), which clearly shows that these species are restricted to paleoecologically different environments. It seems that *Triasina hantkeni* occurs in more internal, lagoonal subenvironments of the reefal platform, whereas *Galeanella? laticarinata* appears to be restricted to patch reefs and their immediate neighborhood.

On the other hand, as far as microfaunal distribution is concerned, we find a difference in the occurrence of the Aulotortidae in the two sections. *Aulotortus* spp., *Auloconus permodisoides*, and in particular *Triasina oberhauseri* and *Triasina hantkeni* appear about 10 m deeper at Site 761 than at Site 764. A similar difference in depth of occurrence was also found for *Ophthalmidium*, the Duostominidae, the “Trochamminidae,” and the Nodosariidae. *Gandinella falsofriedli*, however, first appears in both sections at approximately the same level.

MICROPALAEONTOLOGICAL COMPARISON WITH OTHER TRIASSIC TETHYAN LOCALITIES

The northwest Australian Triassic foraminiferal fauna shows the closest affinity with that of the Indonesian locality of Seram (Al-Shaibani et al., 1984). The more important species of the Rhaetian of Seram are *Triasina hantkeni*, which is abundant, several species of *Aulotortus*, Duostominidae, and "Trochamminidae." The other biostratigraphically significant species that occur, but are typically rare in the Upper Triassic of the Tethys, are "*Tetrataxis*" *inflata*, *Duotaxis birmanica*, which was originally recorded in the Upper Triassic of Burma, and *Galeanella? laticarinata*, which was first described from Seram (Al-Shaibani et al., 1983) and seems to be paleogeographically restricted to the Eastern Tethys. The northwest Australian occurrence of this species is apparently the first record from outside Seram. On the other hand, *Miliolipora cuvillieri* Brönnimann and Zaninetti and thick-walled galeanellas, both relatively abundant in the reefal Triassic of Seram, are absent at the Australian Wombat Plateau.

It has to be pointed out that the micropaleontological similarities between the Indonesian and Australian localities require further stratigraphic investigation in order to establish the paleogeography of the Upper Triassic carbonate platforms in the Eastern Tethys realm. However, the presence of *Triasina hantkeni* permits the identification of the Rhaetian interval at both localities. The characteristic species, *Galeanella? laticarinata*, considered to be Norian-Rhaetian in age at the type locality of Seram, occurs at Site 764 in the same stratigraphic interval containing *Triasina hantkeni*. This allows us to establish a Rhaetian age for *Galeanella? laticarinata* on the Wombat Plateau and probably as well for the Upper Triassic locality of Seram.

The microfaunas from Sites 761 and 764 also have a certain resemblance to those of Late Triassic age from the Caucasus (Efimova, 1974, 1975), at least concerning *Aulotortus* spp., *Auloconus*, "*Tetrataxis*," *Ophthalmidium*, "Trochamminidae," Duostominidae, and Nodosariidae. In the Caucasus area *Triasina hantkeni* seems to be absent, but other foraminifers reported by Efimova were not found on the Wombat Plateau—in particular, *Miliolipora*, *Sigmoilina*, and *Agathammina*.

The Rhaetian of New Guinea (Kristan-Tollmann, 1986) also contains microfaunas that, in part, can be compared to those from northwest Australia. At the New Guinea locality, on the basis of the illustrations, the Aulotortidae and the Glomospirellas seem to predominate and the new species described from the Rhaetian of New Guinea—*Glomospirella wahgiensis* Kristan-Tollmann—looks very similar to *Gandinella falsofriedli* and is probably a junior synonym. *Miliolina*, with *Planinivoluta* and *Miliolipora*, and the Duostominidae are also present in New Guinea.

The microfaunas of the Wombat Plateau are also related to those from the Upper Triassic of China (He Yan and Hu Lan-Ying, 1977; He Yan, 1982), as shown by the occurrence at the Chinese localities of "Trochamminidae," "*Tetrataxis*," *Glomospirella*, *Aulotortus* spp., Duostominidae, and Nodosariidae. As far as the distribution of *Triasina hantkeni* in the Eastern Tethys is concerned, the species has also been described in China (He Yan, 1980) and in the Philippine Islands (Fontaine et al., 1979; see also Al-Shaibani et al., 1982).

In contrast to the aforementioned localities, the microfaunas described by Heath and Apthorpe (1986) from the Lower? and Middle Triassic of the Northwest Shelf, Western Australia, are dominated by the Nodosariidae and differ strongly

from those of the Wombat Plateau. They show, in our opinion, more of a Jurassic (Cretaceous?) affinity than that of the Triassic.

Finally, there is no similarity to either the Late Triassic microfaunas from the shallow carbonate platform drilled during ODP Leg 122 or the Late Triassic (probably Rhaetian) foraminifers from the northern Exmouth Plateau, northwest Australia, studied by Kristan-Tollmann and Gramann (this volume). The occurrence in this latter locality of rare Aulotortidae ("*Glomospirella*" *friedli* = *Aulotortus friedli*) and abundant Involutinidae (*Involutina liassica*, *Involutina turgida*, *Trocholina turris*, *Trocholina crassa*, and *Coronipora austriaca*) suggests a deeper sedimentary environment than that of the assemblages from Sites 761 and 764 on the Wombat Plateau, ranging from outer shelf to basin, according to the paleoecology of the Involutinidae in the Alps (see also Piller, 1978).

PALEOECOLOGICAL AND STRATIGRAPHIC CONCLUSIONS

Paleoecology

The alternating occurrence at Sites 761 and 764 of Aulotortidae (*Aulotortus*, *Auloconus*, and *Triasina*) and smaller foraminifers (*Duotaxis*, "*Tetrataxis*," "Trochamminidae," and *Ophthalmidium*) is characteristic of reefal platforms. This environment can, however, be differentiated into an inner zone (lagoon to patch reef), with abundant Aulotortidae, and a more external zone (patch reef to outer shelf) with small microgranular or porcelaneous foraminifers (Fig. 1C).

The occurrence of *Galeanella? laticarinata* in several cores at Site 764 places this site in a more external reefal environment than that of Site 761, where lagoonal facies with Aulotortidae are predominant.

Stratigraphy

On the basis of *Triasina oberhauseri* and *Triasina hantkeni*, the samples examined from both Sites 761 and 764 are of late Norian to Rhaetian age. *Triasina oberhauseri* has been reported from various Norian localities of the Western Tethys (Koehn-Zaninetti and Brönnimann, 1968; Brönnimann et al., 1970; Abate et al., 1984) and *Triasina hantkeni* defines the Rhaetian *Triasina hantkeni* Biozone (Gazdzicki et al., 1979; Gazdzicki, 1983; Gazdzicki and Reid, 1983; Abate et al., 1984; Ciarapica and Zaninetti, 1984; Vachard and Fonatine, 1988) throughout the Tethyan realm.

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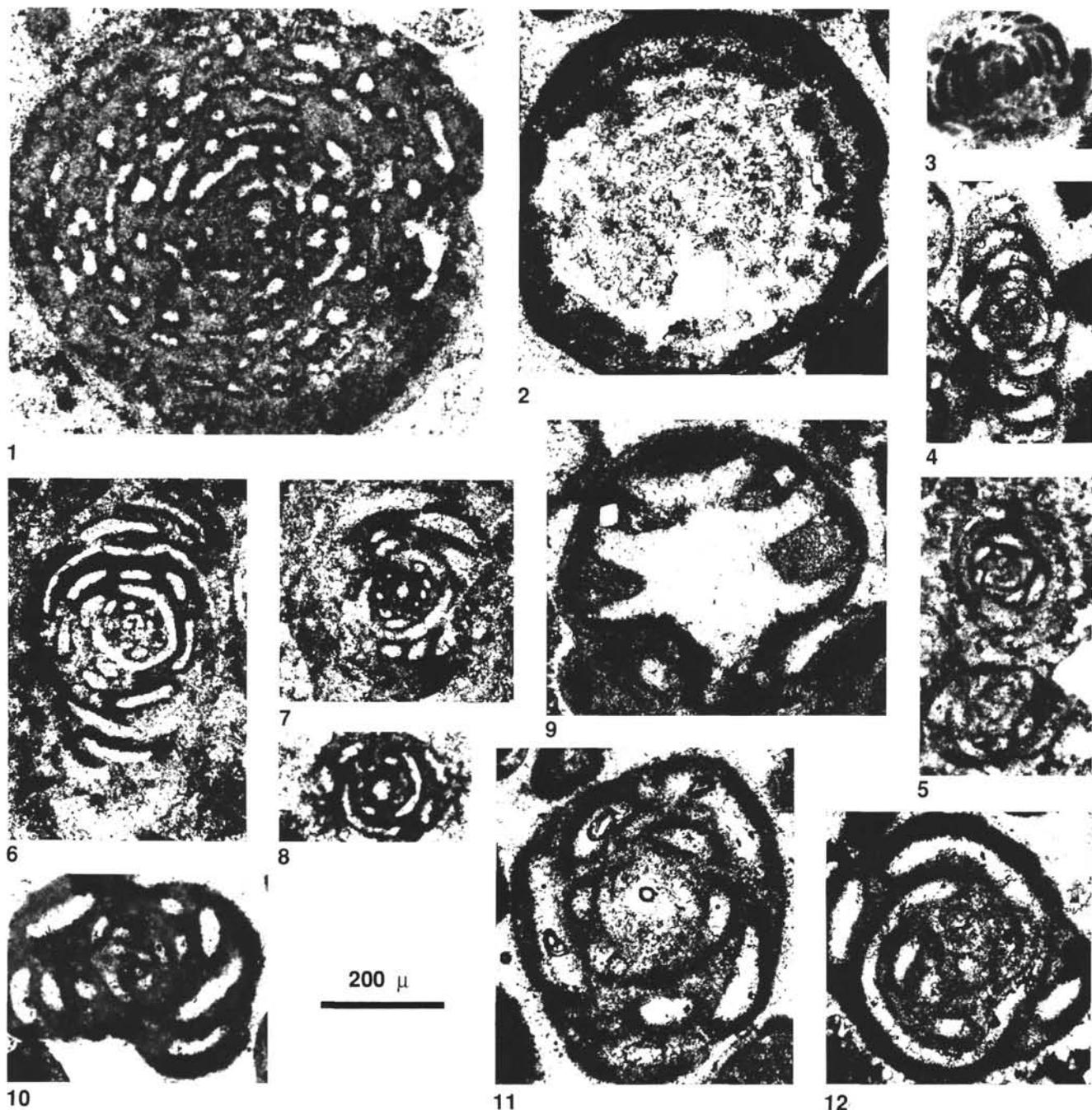


Plate 1. 1, 2. *Triasina hantkeni* Majzon; (1) Sample 122-761C-16R-1, 23–26 cm, (2) Sample 122-761C-12R-1, 16–19 cm. 3. *Triasina oberhauseri* Koehn-Zaninetti and Brönnimann, Sample 122-761C-32R-3, 2–4 cm. 4. *Gandinella* sp. aff. *G. falsofriedli* (Salaj, Borza, and Samuel), Sample 122-761C-13R-1, 6–9 cm. 5. *Gandinella falsofriedli* (Salaj, Borza, and Samuel), Sample 122-761C-13R-1, 1–3 cm. 6–8. *Gandinella?* sp., Sample 122-761C-16R-1, 23–26 cm. 9. *Auloconus?* sp., Sample 122-761C-16R-1, 52–55 cm. 10. Indeterminate foraminifer, Sample 122-761C-12R-1, 16–19 cm. 11, 12. *Aulotortus friedli?* (Kristan-Tollmann), micritized specimen, Sample 122-761C-12R-1, 16–19 cm.

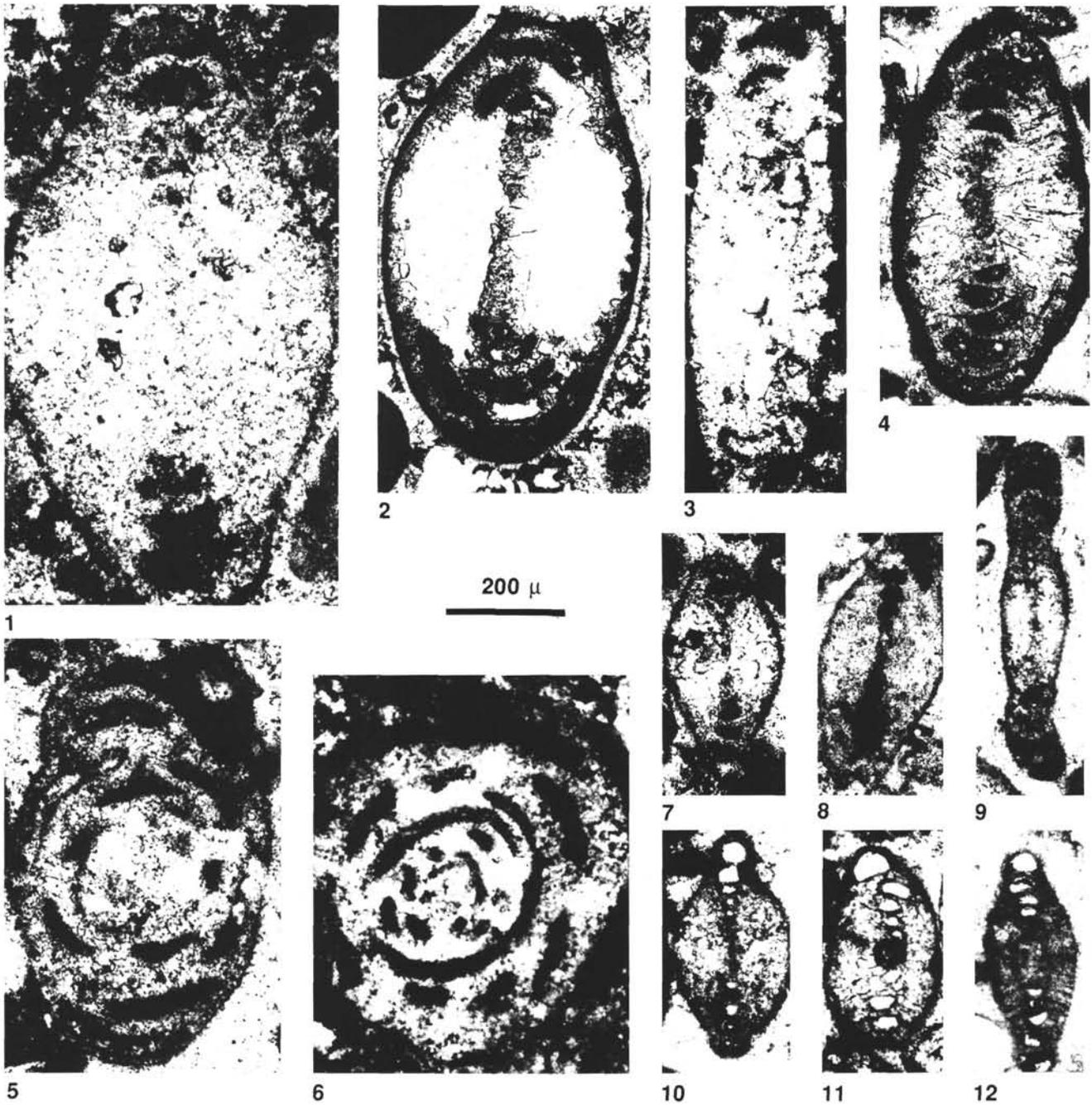


Plate 2. 1, 2, 4. *Aulotortus sinuosus pragsoides* (Oberhauser); (1) Sample 122-761C-13R-1, 1-3 cm, (2) Sample 122-761C-12R-1, 16-19 cm, (4) Sample 122-761C-32R-CC, 3-5 cm. 3. *Aulotortus* aff. *tenuis* (Kristan), Sample 122-761C-15R-1, 44-47 cm. 5, 6. *Aulotortus friedli* (Kristan-Tollmann); (5) Sample 122-761C-16R-1, 52-55 cm, (6) Sample 122-761C-13R-1, 1-3 cm. 7, 8, 10-12. *Aulotortus communis* (Kristan); (7, 8) Sample 122-761C-16R-1, 52-55 cm, (10-12) Sample 122-761C-31R-CC, 3-5 cm. 9. *Aulotortus tumidus* (Kristan-Tollmann), Sample 122-761C-13R-1, 6-9 cm.

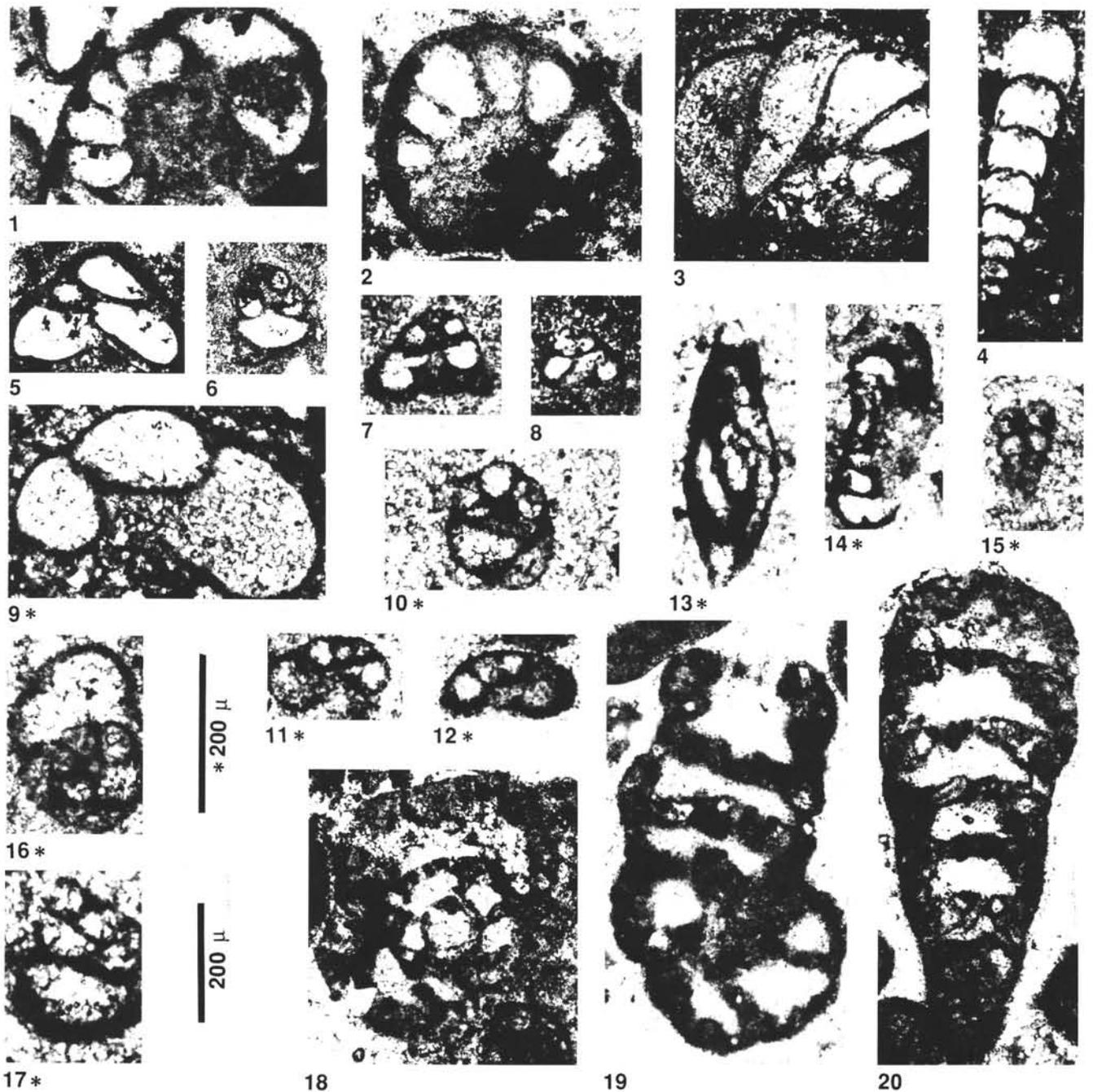


Plate 3. 1-3. Duostominidae; (1) Sample 122-761C-32R-3, 2-4 cm, (2) Sample 122-761C-16R-1, 52-55 cm, (3) Sample 122-761C-24R-1, 69-73 cm. 4. Nodosariidae, Sample 122-761C-15R-1, 44-47 cm. 5. *Duotaxis birmanica* Zaninetti and Brönnimann in Brönnimann et al. (1975), Sample 122-761C-24R-1, 69-73 cm. 6-8. "*Tetrataxis*?" sp.; (6) Sample 122-761C-24R-CC, 11-15 cm, (7, 8) Sample 122-761C-24R-1, 69-73 cm. 9. "Trochamminidae" or Duostominidae, Sample 122-761C-26R-CC, 16-19 cm. 10-12. "Trochamminidae?"; (10) Sample 122-761C-26R-4, 65-67 cm, (11, 12) Sample 122-761C-26R-1, 1-4 cm. 13. *Ophthalmidium* sp., Sample 122-761C-26R-4, 65-67 cm. 14, 17. Indeterminate foraminifers; (14) Sample 122-761C-26R-1, 1-4 cm, (17) Sample 122-761C-26R-4, 65-67 cm. 15. Textulariidae?, Sample 122-761C-26R-6, 136-139 cm. 16. Endothyridae, Sample 122-761C-26R-6, 136-139 cm. 18. Lituolidae?, Sample 122-761C-16R-1, 23-26 cm. 19, 20. *Ammobaculites* sp., Sample 122-761C-12R-1, 16-19 cm.

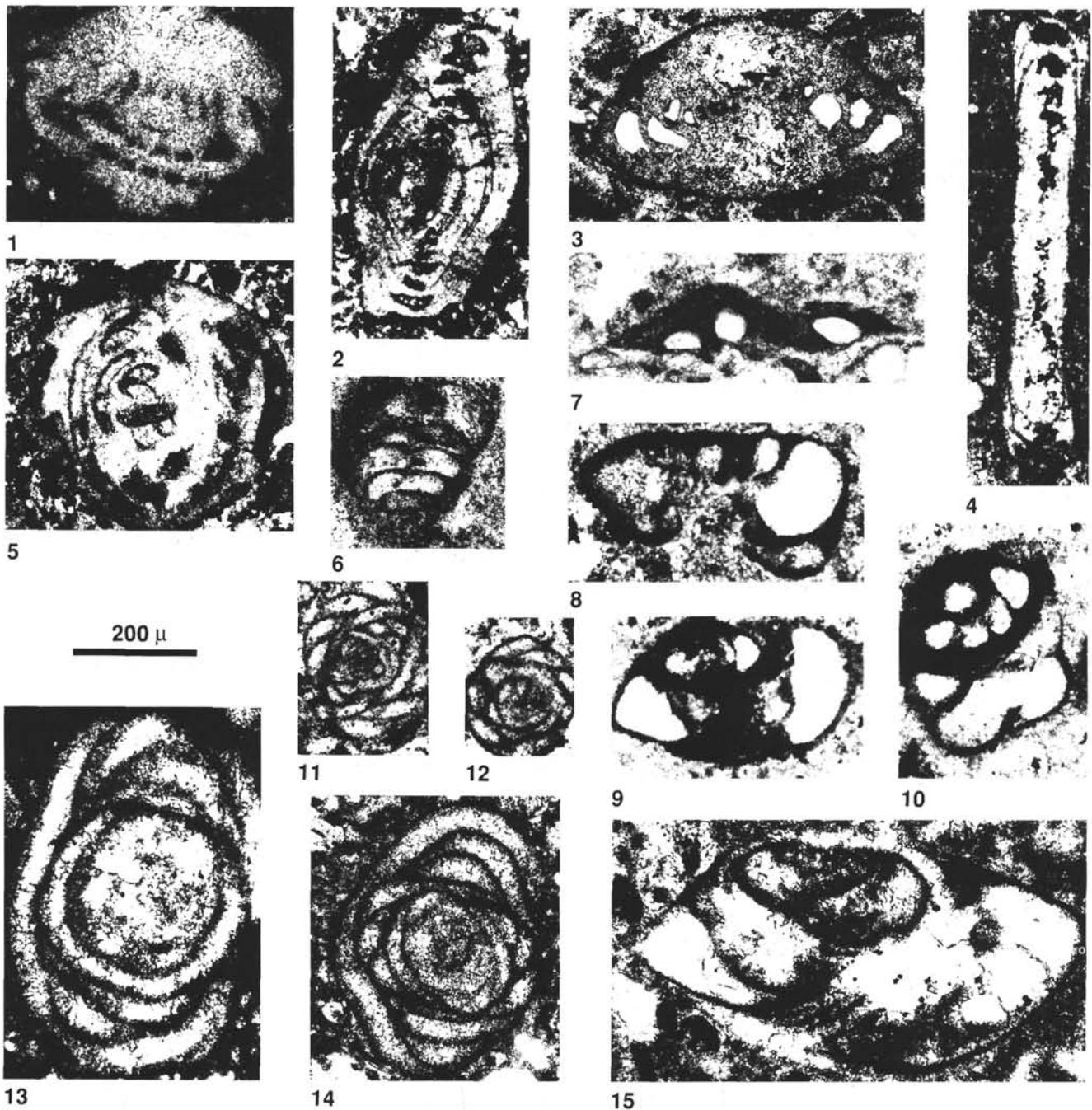


Plate 4. 1. *Triasina oberhauseri* Koehn-Zaninetti, and Brönnimann, Sample 122-764B-27R-1, 60–64 cm. 2. *Aulotortus communis* (Kristan), Sample 122-764B-5R-1, 43–47 cm. 3. *Auloconus permodiscoides* (Oberhauser), Sample 122-764B-5R-1, 9–13 cm. 4. *Aulotortus?* sp., Sample 122-764B-8R-CC, 4–8 cm. 5. *Aulotortus friedli* (Kristan-Tollmann), Sample 122-764B-7R-1, 24–27 cm. 6. Ataxophragmiidae, Sample 122-764B-23R-1, 72–76 cm. 7. *Planiinvoluta? irregularis* Salaj, Borza, and Samuel, Sample 122-764B-14R-CC, 5–8 cm. 8–10. Duostominidae, Sample 122-764B-8R-CC, 25–29 cm. 11, 12. *Gandinella falsofriedli* (Salaj, Borza, and Samuel), Sample 122-764B-5R-1, 9–13 cm. 13, 14. *Gandinella?* sp.; (13) Sample 122-764B-11R-1, 4–7 cm, (14) Sample 122-764B-10R-1, 10–15 cm. 15. Duostominidae with two-layered wall, Sample 122-764B-14R-CC, 5–8 cm.

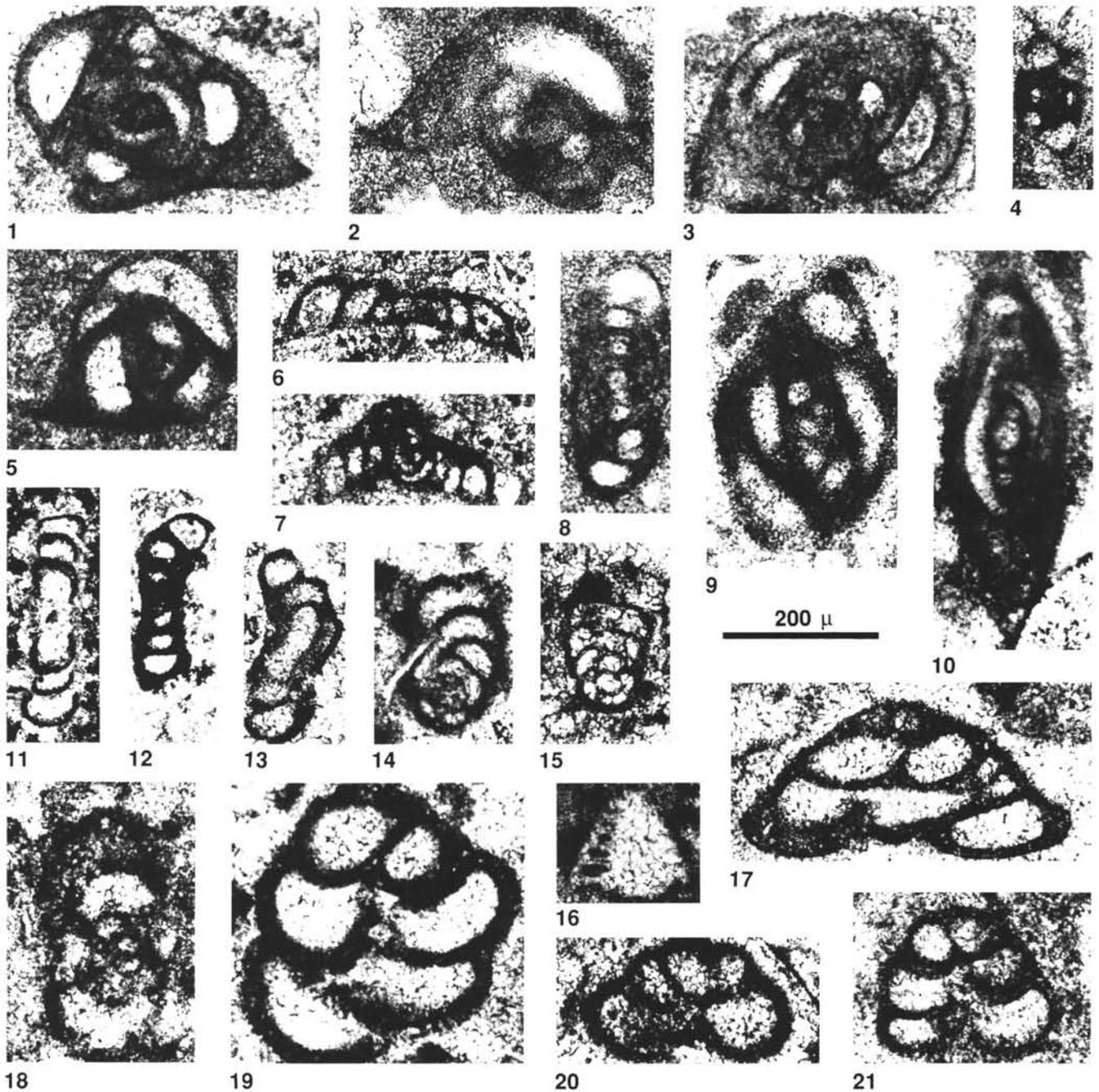


Plate 5. 1-3, 5. *Galeanella? laticarinata* Al-Shaibani, Carter, and Zaninetti; (1-3) Sample 122-764B-23R-1, 72-76 cm, (5) Sample 122-764B-24R-CC, 1-4 cm. 4. Miliolidae? indet., Sample 122-764B-20R-1, 94-98 cm. 6, 7. *Planiinvoluta carinata* Leischner; (6) Sample 122-764B-8R-CC, 4-8 cm, (7) Sample 122-764B-7R-1, 12-14 cm. 8-10. *Ophthalmidium* spp.; (8) Sample 122-764B-20R-1, 94-98 cm, (9) Sample 122-764B-20R-1, 37-40 cm, (10) Sample 122-764B-20R-1, 72-76 cm. 11. Indeterminate foraminifer with two-layered wall, Sample 122-764B-7R-1, 12-14 cm. 12-15. Indeterminate foraminifers; (12, 13, 15) Sample 122-764B-7R-1, 12-14 cm, (14) Sample 122-764B-14R-CC, 5-8 cm. 16. *Trocholina* sp., Sample 122-764B-27R-1, 60-64 cm. 17, 19-21. "*Tetrataxis*" *inflata* Kristan, Sample 122-764B-14R-CC, 5-8 cm. 18. Endothyridae, Sample 122-764B-14R-CC, 5-8 cm.